2023 ANNUAL REVIEW MEETING

February 22 – 27, 2023
Country Level Opportunities & National Program Review

SENEGAL
Pearl millet and Sorghum = 2nd and 4th most produced cereal crops in Senegal
Senegal ranks 5th and 12th for pearl millet and sorghum production in Africa
SMIL in Senegal – 5 projects implemented by ISRA and ITA

**GENMIL**
- Genetic Enhancement of Pearl Millet for Yield, Biotic and Abiotic Stress Tolerance in West Africa
  - PI – Ndjido A. Kane (ISRA/CERAAS); Co-PI – Ghislain Kanfany (ISRA/CERAAS)

**SMIL-DIGEST**
- Sorghum Trait Deployment Pipeline for Improved Food and Feed Value
  - Co-PI – Elisabeth Diatta-Holgate (ISRA/CERAAS), Cyril Diatta (ISRA/CNRA)

**SAWAGEN**
- Improving Sorghum Adaptation in West Africa with a Genomics-Enabled Breeding Network
  - Co-PI – Bassirou Sine (ISRA/CERAAS), Cyril Diatta (ISRA/CNRA)

**SMIL-PATHO**
- Enabling Marker Assisted Selection for Sorghum Disease Resistance in Senegal and Niger
  - Co-PI – Mame Penda Sarr Diawara (ISRA/CNRA)

**SMIL-NUTRI**
- Expanding Markets for Sorghum and Millet Farmers in West Africa Through Strengthening of Women and Youth Processors and Nutrition-based Promotion of Products
  - Co-PI – Cheikh Ndiaye (ITA)
Key Achievements

(1) Improved Technologies for More Resilient Food Systems

(2) Strengthened Partnerships (from Research to Delivery)

(3) Enhanced Human and Institutional Capacities
Trait Discovery & Mapping

Germplasm

- Characterized diversity collections
- Trait donors (yield potential, drought tolerance, disease resistance, Fe/Zn, etc.)
- Mapping populations

Genes/Loci and Markers

- Markers for protein digestibility, striga resistance, stay green (sorghum)
- QTLs for flowering, root traits, striga resistance (pearl millet)
Enhanced Breeding Efficiency with Modern Approaches

Breeding Methods & Tools

• Demand-based breeding product profiles
• OPVs and hybrids (millet & sorghum)
• Marker-assisted selection at early generations (where applicable)
• New breeding schemes – BCNAMs, genomic prediction (millet)

Breeding Informatics & Data Management

• Through the IBP platform
• National breeding data & regional evaluations data
• Barcoding & digital data collection (where applicable)

High Throughput Phenotyping & Modelling

• Drone-based phenotyping supplemented with AI & machine learning (sorghum & pearl millet)
• Root trait modeling (pearl millet)
• TPE characterization (sorghum)
## Improved Sorghum Varieties

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<tr>
<th>Varieties</th>
<th>Status</th>
<th>Potential Users</th>
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| • 6 dual purpose, tannin-free varieties: Payenne, Golobé, Faourou, Darou, Nganda, Nguinthe (Grain & Fodder) | PLC Phase 4 Released and made available     | Seed and grain producers
 Seed dealers
 Processors
 Consumers
 Livestock Farmers
 Agri-industry (flour, food products, animal feeds)                        |
| • 3 tannin-free dual-purpose lines, resistant to grain mold               | PLC Phase 3 To be proposed for release in 2023 |                                                                                 |
| • 3 lines with high post-cooking protein digestibility (> 60%)            |                                             |                                                                                 |
| • 2 tannin-free hybrids, resistant to grain mold                         |                                             |                                                                                 |

Breeding lines under development/evaluation for striga resistance, stay green trait, anthracnose resistance & combined grain mold and anthracnose resistance, moderate photoperiodism and open panicles.
### Improved Pearl Millet Varieties

**Varieties** | **Status** | **Potential Users**
--- | --- | ---
* Open pollinated varieties (OPV), 2.5-3.5 t ha⁻¹
  > Intermediate – 90 to 105 days: SL 423, SL 169, SL 28, Thialack 2
  > Early – 65 à 85 days: Gawane, GB 8735, Chakti (++Fe)

* Early high-yielding topcross hybrid – 3-4 t ha⁻¹, 70-80 days: TAAW

* Dual purpose late maturing OPV – 120 days: Salam

* 5 high yielding single cross hybrids

PLC Phase 4
Released and made available
Seed and grain producers
Seed dealers
Processors
Consumers
Agri-industry (flour, food products, animal feeds)

PLC Phase 3
To be proposed for release in 2023

Breeding lines under development/evaluation for striga resistance, downy mildew, stay green, compact panicles.
Production Guides and Technical Sheets

Good practices for grain and seed production of hybrids and non-hybrid varieties
Sorghum and Pearl Millet-Based Food/Feed Products

Blended flour bread and pasta (15-30% sorghum/millet)

• Fast cooking arraw using malt flours
• Instant arraw/couscous through extrusion

Enriched flours (Fe, Zn, Vit A) & Instant infant flours

Animal Feeds
> More research is needed to effectively substitute maize and develop appropriate formulations for sorghum grain and fodder uses
Key Achievements

(1) Improved Technologies for More Resilient Food Systems

(2) Strengthened Partnerships (from Research to Delivery)

(3) Enhanced Human and Institutional Capacities
A Collaborative Open-Access Book

Co-edited by CERAAS, CIRAD and KSU

Published online in Dec. 2022

Great learning experience!

3 sections
19 chapters
120 authors affiliated to 31 agricultural R&D organizations and universities

Benin (4), Côte d'Ivoire (1), France (31), Ghana (1), Guinea (1), Mali (17), Niger (3), Nigeria (3), Saudi Arabia (3), Senegal (37), UK (8) and USA (11).
Technology Evaluation & Scaling with Public/Private Actors

PLC-Phase 1
Research

- Agricultural advisory services (*e.g.* ANCAR, DRDR, SDRDR)
- Farmer Organizations (*e.g.* RESOPP, PMP, UGAD, Bamtaare)
- NGOs (*e.g.* Pencum Bambuk, CARITAS)

PLC-Phase 2
Field Testing

- Seed enterprises (*e.g.* UNIS/SEDAB)
- Processors (Cooperatives, SMEs, Women associations)

PLC-Phase 3 – Made Available for Uptake

- Agri-industry (*e.g.* Mamelles Jaboot, AgroSaafi, NMA, Sedima)

PLC-Phase 4
Demonstrated uptake

**Demand-driven generation of technologies**

**On-farm testing and participatory evaluations**

**On-farm demonstration and scaling**

**Adoption and use**
Consultation workshop with implementing partners and other stakeholders  
Feb 2023

Positive feedback: latest improved varieties have met their expectations and there is willingness to use them.

Key issue raised: lack of sustainable grain and seed availability and high price volatility.
Key Achievements

(1) Improved Technologies for More Resilient Food Systems
(2) Strengthened Partnerships (from Research to Delivery)
(3) Enhanced Human and Institutional Capacities
Enhanced Research Capacity & Quality

Infrastructure & Equipment: ITA sensory lab, protein digestibility lab at CERAAS

Scientific communications:
>>Publications (38), presentations (60)

Short term training: 8,923 people (incl. 37.8% W) trained on various topics

Degree training: 31 students including
15 women, 13 PhD students, 17 MSc/Agric eng., 1BSc

Officially opened in Nov. 2022

Student retention & career development
Opportunities & The Way Forward
Synergies with Other Projects, Programs & Initiatives

- ILCI / CIWA & CASSI (Crop improvement, Gender, Youth, Nutrition & Seed Systems)
- SIIL (Intensification options for dual-purpose pearl millet varieties)
- FPIL (Processing, New food products development & Market)
- DESIRA / ABEES (Modern & demand-led breeding approaches)
- USAID / PAIRED (Variety scaling)
- IBP-IFAD / EBCA (Digitized breeding programs)
- AfDB/TAAT (Technology scaling)
• CORAF-led initiatives – iREACH (TechPark) and MITA platform

• Food Sovereignty Program of the Senegalese Ministry of Agriculture & World Bank FSRP

• Upcoming blended flour law regulation (20% admixture)

• AFSTA conference 6-8 March 2023, Dakar
Prospects

• Advance the development, release and diffusion of high yielding, climate resilient and pest & disease resistant sorghum and pearl millet varieties that have high nutritional value. (commercialization of hybrid varieties???)

• Define effective strategies to:
  > enhance urban and rural consumption of sorghum and pearl millet under diverse forms (food, feed, beverage)
  > sustain sufficient production and distribution of sorghum and pearl millet seeds and grains

• Put in place an efficient market-oriented and specialty breeding program
  > matching a variety profile with a commercialized/high market-share product.
Thank you for your attention

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

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